Title: Let's Be Fair!

Brief Overview:

The children will explore the concept of a fair game using experimentation and their knowledge of probability. They will analyze and play various board games. The students will design and construct an original board game as a culminating activity.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers and problems which are solved in a cooperative atmosphere.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and signs, symbols and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and within other disciplines (Language Arts, Art).

- **Statistics and Probability**
  Students will demonstrate their ability to collect, organize, and display data and will interpret information obtained from displays. They will write reports based on statistical information.

Grade/Level:

Grade 3

Duration/Length:

This learning unit will take approximately eight periods (50-60 minutes).

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- outcomes
- tallying
- frequency tables
- probability
- fractions
- circle graphs

Objectives:

Students will:

- determine the fairness of using cubes, spinners, and a die (number cube) in a game.
- work cooperatively in groups.
- record information.
- tally the results of experiments.
- analyze data orally and in writing.
- draw conclusions orally and in writing.
- construct a board game using specific guidelines.
- present an oral report.
- express themselves mathematically in writing.

Materials/Resources/Printed Materials:

- Teacher Resource sheets (TR) 1-3
- Student Resource sheets (SR) 1-6
- Paper lunch bags (2 for each pair of students)
- Colored cubes (8 blue and 4 red for each pair of students)
- Assorted board games that use a spinner, one die, or cubes/cards (i.e.,Candy Land)
- Game making materials (card board, construction paper, markers, etc.)
- Die (one for each pair of students)
- Rulers

Development/Procedures:

Note: Student will need a working knowledge of writing directions by day 5.

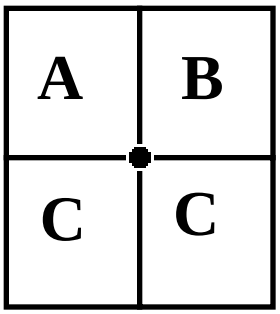
Day 1:

1. Review the meanings of the terms outcomes, chance, likely, unlikely, certain, impossible, and probability. **TR 1** can be used as a resource.
2. Ask "What does it mean to have a fair chance?"
3. Have class will play IT'S IN THE BAG **(SR 1)**. See **TR 2** for directions.
4. Discuss students' experience with games and their outcomes.
5. Have children complete **SR 2** to further investigate fairness.
6. Discuss the responses to **SR 2** and collect.
7. Inform children tomorrow they will continue investigating fairness in games using spinners.

Day 2:

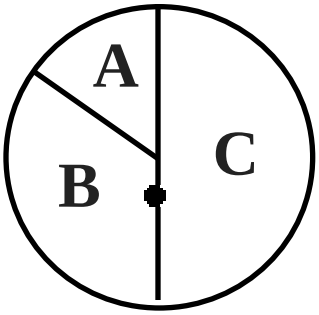
1. Review what the children learned on Day 1.
2. Draw the spinner 1 on the chalkboard. The spinner can be a circle or square.

Spinner 1



3. Ask for three volunteers who will represent each letter. Tell the students each volunteer will get a point when the spinner lands on his or her letter. Have children vote on who will win.
4. Discuss results. Ask was this a fair game? Why or why not? Establish that C had a better chance (2 out of 4) of winning.
5. Draw spinner 2. Repeat procedure from steps 3 and 4.

Spinner 2



6. Have students think, pair, share discussing how they can make spinners 1 and 2 fair? Discuss responses with the whole class.
7. Give each group a spinner template **(SR 3)** to create a fair spinner.
8. Discuss and display products.
9. Have children write in their journal: How do you determine whether a game is fair? Tell how the experiments from yesterday and today helped you understand the words fair and not fair.
10. Tell the students tomorrow they will continue their investigations of fairness in games using one die (number cube).

Day 3:

1. Briefly discuss the cube lesson (It's In The Bag) and the spinner lesson. Review fairness.
2. Show students a large die (number cube) and have them identify it.
3. Have the students complete **SR 4**.
4. Discuss results and discuss fairness using the die.
5. Brainstorm different board games as a class. List all answers on chalkboard.
6. List the characteristics of a board game. Elicit students to say title, rules, directions, board, playing pieces, etc. (Note: Students may not think to add fairness at this time.)
7. Tell children tomorrow they will explore board games.

Day 4:

1. Summarize the past three lessons with the children.
2. Give an assortment (2-3) of board games to each group of four children
3. Have the children work in groups to analyze the games and record their common characteristics.
4. Refer back to the chart from day 3 and discuss what information should be omitted or added and tell why.
5. Allow the children to play one of the games for further exploration. Allot 20 minutes.
6. Discuss the different games and their chances of winning.
7. Have children relate the equal chance of winning (fairness) to the characteristics of a board game.
8. Add fairness to the chart.
9. Have the class write in their journals about the game they have played and why it was fair mathematically.
10. Tell children they will use their knowledge to construct a fair board game.

Days 5 and 6:

Give performance assessment vignette **(SR 5)** to the group and begin working.

Day 7:

Have children share their games with the class and explain why their game is fair.

Day 8:

1. Have students complete the evaluation **(SR 6)**.
2. Allow children to play their games.

Performance Assessment:

Use students' worksheets, journal entries, and oral responses to assess daily performance. Have students complete the performance assessment vignette on student resource 5. The scoring tool is found on teacher resource 3.

Extension/Follow Up:

1. Have children write a friendly letter to a toy store persuading the manager to sell their game.
2. Invite other third grade classes to play the games.
3. Create other games that relate to other curriculum areas.
4. Read and discuss the book No Fair! by Caren Holtzman, published by Scholastic

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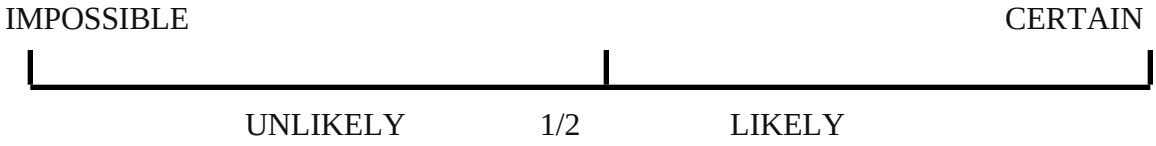
PROBABILITY SCALE



Teacher's Directions for IT'S IN THE BAG

Arrange your students in pairs.

Materials needed:

- 2 paper bags for each pair. One labeled #1 and the other labeled #2
- 8 blue cubes
- 4 red cubes
- one tally sheet for each pair (SR 1)
- one LET'S INVESTIGATE sheet (SR 2) for each student

Ahead of time:

- Place 5 blue cubes and 1 red cube in bags #1
- Place 3 blue cubes and 3 red cubes in bags #2
- Duplicate SR 1 and SR 2

Procedure:

1. Tell students that they are going to play games based on chance to see which student in each pair can score 10 points first. (NOTE: The number of points can be changed.) When they are finished playing, they will discuss and analyze the results of the game.
2. Assign a blue player and a red player in each pair. Decide who will go first.
3. Explain the rules of the game:
   Without looking players will alternately pick a cube from the bag. If the cube is blue, the blue player gets a point. If the cube drawn is red, the red player scores a point. The cube then gets put back into the bag and the next player picks. The first player to score 10 points is the winner.
4. Model the game if necessary.
5. Distribute bag #1 and SR 1
6. Let the children play at least 2 games in the assigned time and tally their results on SR 1.
7. Then, make a class chart or graph showing the winners(colors) of each game played[blue, blue, etc.] Discuss the results with the children. **There should be more blue than red.
8. Distribute bag #2 and repeat steps 3, 6, and 7. ** This time there should be a more even distribution.
9. Have children investigate the results more closely by completing LET'S INVESTIGATE SR 2.
10. When done, discuss student responses. Make certain students identify a game as being fair when all players have an equal chance of winning.

IT'S IN THE BAG

DIRECTIONS:
1. List the name of the student who is :

BLUE: _____

RED: _____

2. **WITHOUT LOOKING**, choose one cube from the bag. If the cube is blue, give the blue player a point. If it is red, give the red player a point. Then return the cube to the bag. Keep going until a player scores 15 points. Tally your results below.

BAG 1

BLUE	RED	BLUE	RED	BLUE	RED

WINNER: _____ WINNER: _____ WINNER: _____

3. Tally your results from the game using bag 2 below.

BAG 2

BLUE	RED	BLUE	RED	BLUE	RED

WINNER: _____ WINNER: _____ WINNER: _____

NAME: DATE:

LET'S INVESTIGATE

Read and follow the directions. Complete your written work independently in compete sentences.

1. Empty bag 1. Describe or draw what was in your bag.

2. Complete each sentence.

The chance of picking a blue cube was _____ out of _____.

The chance of picking a red cube was _____ out of _____.

3. Was this a fair game? Why ? Support your answer with details.

_____

_____

_____

_____

_____

4. Empty bag 2. Describe or draw its contents.

5. Complete each sentence.

The chance of picking a blue cube was _____ out of _____.

The chance of picking a red cube was _____ out of _____.

6. Was this a fair game? Why? Support your answer with details.

_____

_____

_____

_____

_____

Based on your playing the games and this investigation, how would you define fairness in a game? Write your answer in complete sentences.

_____

_____

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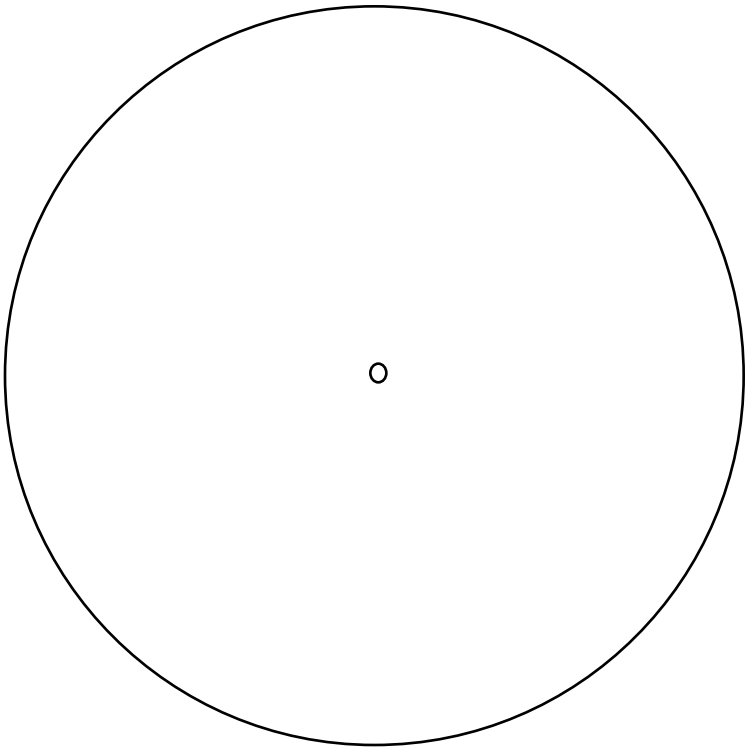
_____

MAKING A SPINNER

USE THE MODEL BELOW TO CREATE A FAIR SPINNER WITH AT LEAST FOUR POSSIBLE OUTCOMES.



Explain why your spinner is fair.

_____

_____

_____

_____

_____

NAME: DATE:

DIE INVESTIGATION

IS ROLLING A DIE A FAIR WAY TO PLAY A GAME?

You will need a die to do this investigation.

One person will keep rolling the die for five minutes. The other person will tally the results below. After 5 minutes change. The tally person will become the roller and the roller will continue the tallying. Compute the totals after 10 minutes.

roll	tally	total
1		
2		
3		
4		
5		
6		

Analyze the data with your partner. What did both of you discover? What conclusions can you come to about the fairness of using a die in a game? Support your answers with information from your investigation.

_____

_____

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_____

_____

NAMES: DATE:

Game Makers Wanted

Your class enjoys playing board games. However, they are tired of the games in the classroom. The class has been learning about probability, fairness, and studying games and are now experts in these fields. They feel that they can add more games to the class collection. You and a partner will construct a new board game that your class can play. Your game must have the following:

1. Title
2. Gameboard
3. Object of the game
4. Directions written in a logical sequence
5. A spinner, die (number cube), or cards/cubes with at least six possible outcomes.

You and your partner must make certain that your game is a fair one. So each of you will include a paragraph explaining mathematically why your game is fair.

When you are done, you and your partner will show and explain your game to the class. Each of you will also tell them why your game is fair.

Game Makers Wanted Scoring Tool

Your oral presentation was: Points Earned

1. well-organized (5 pts.) _____

*2. clearly presented (5 pts.) _____

The students have included:

1. a game title (1 pt.) _____

2. gameboard (4 pts.) _____

3. object of the game (1 pt.) _____

4. clearly written sequential directions (5 pts.) _____

5. a spinner, die, or cards/cubes with at least 6 possible outcomes (4 pts.) _____

*6. a written explanation that tells why your game is fair (10 pts.) _____

Total points possible: Your score:

10 pts. of oral presentation _____

25 pts.for game _____

*These items are scored separately for each individual student.

Names:

STUDENT EVALUATION SHEET

Circle your answer.
This activity was:

easy	somewhat easy	just right	somewhat hard	hard

Why do you feel the way you do? What is your opinion of this activity? Do you have any suggestions? Be certain to support your answers.

_____

_____

_____

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_____

NAME: DATE: